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(21) International Application Number: PCT/SE91/00570 (22) International Filing Date: 30 August 1991 (30.08.91) (30) Priority data: 9002781-4 31 August 1990 (31.08.90) SE (71)(72) Applicant and Inventor: LJUNGBO, Sven [SE/SE]; Box 111, S-198 00 Bålsta (SE). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), HU, IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, RO, SE (European patent), SU ⁺ , US.		Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>
(54) Title: GLUEING METHOD IN PRODUCTION OF FIBRE BODIES ACCORDING TO THE DRY METHOD (57) Abstract The invention relates to the glueing method at the manufacturing of fibre bodies, disks, profiles, panels, insulating carpets, packing material etc - according to the dry method. It consists in the fact that the glue is composed of water glass powder, which is mixed with the fibres which have been somewhat moistured before or during the blending and then, together with the fibres are blown into the moulder to be die-pressed to intended fibre body. During the process the glue powder is dissolved in the water present, transcending into plastic or liquid form so as to aggluminate the fibres, whereupon it dries and hardens into a solid bond during the die-pressing. To make the method work satisfactorily the silicate powder ought to contain some water, bound as gel-liquid or water of crystallization in the alkali silicate. Thus, spray-dried water glass is appropriate as glue powder. To improve the water resistance of the fibre bodies a hardener transcending the alkali silicate to water insoluble silicates can be added. Suitable hardeners are magnesium oxide, zinc oxide or titanium dioxide.		

+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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GLUEING METHOD IN PRODUCTION OF FIBRE BODIES ACCORDING TO
THE DRY METHOD

The production of fibre bodies - disks, profiles, panels etc. - by the dry method is now increasing. The method is constituted of the following processes: fibres of different types - especially wood fibres - are dispersed in an airstream. This one goes to a forming station or a moulder, where the air is exhausted by suction so that the fibres are packed together in a cake or a slab. This one is then pressed in a hot moulding press at the same time being dried and possibly cured to a body of required form and density.

To obtain sufficient strength in the final product suitable glue materials, dispersed or dissolved in water, are added. According to earlier methods the glue addition is made by injection of the glue into the steam-fiber-stream from the defibrator, producing the wood fibres. Then the fibres are dried strictly observing that the added glue must not be cured if it is a curable one. Then the fibres are dispersed in an air-stream which is blown into a diffuser, giving the air-fibre stream the right width and height, before it streams into the moulder.

According to newer methods the glue injection is made directly into the diffuser with or without previous drying of the fibres from the defibrator.

The sizes, most frequently used, are watersolutions of urea - melamine - or phenolic resins with hardeners. These sizes, however emit health-endangering fumes - formadehyde, phenol - causing problems for the products.

Due to the newer methods tests have also been made with waterglass i. e. water solutions of alkali silicates. But these solutions bring about such difficult disturbances in the process - aggregations to fibre bundles or balls with poor binding to other fibres or poor through-glueing - that no acceptable results have been achieved that way. Also other types of glue with high viscosity give similar disturbances.

According to this invention these problems are solved through adding the glue as a powder, which transcends to plastic or liquid form during the continued process and in the end hardens to a strong adhesive.

The glue powder can be water soluble and then forms a glue solution with water, which either goes with the fibres from the beginning of the process or is added though injection during the process. At the final drying the size powder transcends to a firm bond, joining the fibres. If a specially waterresistant fibre product is required also a hardener for the glue substance can be added. This hardener is added either in powder form separately or mixed with the size powder or as a solution in the water, added during the process.

Alkali silicates have proved suitable as size powder. Compared to the abovementioned thermosets or curable glues they have the advantage of not emitting any harmful fumes and also of increasing the fire resistance of the fibrebodies. The constitution of the alkali silicates or the ratio, i. e. the mole ratio between silicon dioxide and alkali oxide can for sodium or potassium silicates suitably lie between 1,2 and 4,7 but also other ratios give usable alkali silicate powders.

But it is less suitable to use powder of calcined alkali silicate so-called rawglass. This glass requires temperatures far above 100 °C - for a sodium silicate with ratio 3,3 about 150 - 170 °C - to be solved with acceptable speed in the water, that in some phase of the production schedule before the die-pressing has been added to the fibres. The temperature inside the produced fiberbody, for instance a disk, normally does not overreach 130 - 150 °C during the die-pressing. Therefore the silicate powder ought to contain water in the form of crystallization or gel-bound water. This bound water makes the silicate powder quickly dissoluble in the water, added before the pressing already at a temperature lower than the highest press temperatures inside the fibre body.

A silicate powder, suitable for that purpose, is spray-dried water glass. The latter is produced through spraying waterglass so it forms an aerosol, quickly being dried to powder in the hot air. Such a powder of sodium waterglass with ratio 3,3 contains such a high percentage of bound water, that it is quickly dissolved by further added water already at a temperature of about 100 °C.

A condition precedent for the powder-glueing method is that the glue powder is evenly distributed over the fibres at the admixture and is then not separated from those during the airtransport to the moulder. This condition is met by adding a suitable amount of water - 10 to 100 % of the dry weight of the fibres - moistening the fibres to make the powder adhere. This admixture can be made by simple, mechanical stirring.

If a product with a high waterresistance is wanted, a hardener, transcending the alkali silicate to waterinsoluble silicates, can be added.

Different chemical compounds of 2-rated, 3-rated or 4-rated metals can be used as such hardeners. Magnesium oxide, zinc oxide and titanium dioxide have proved especially suitable as hardeners.

The following examples present some application forms of the invention without restricting the same:

Example 1

Firchips are defibrated in a disk defibrator. The warm fibres are separated from the steam in a cyclone, from which they, by transport screw and conveyor belt, are taken to a cutter, which disperses them in an airstream, leading into a diffuser. In this diffuser spraydried sodium silicate powder with ratio 3,3 is blown into the fibre-air-stream and is mixed with the fibers, ratio of components being 10 - 25 parts silicate powder to 100 parts dry fibre. The moisture content of the fibre is 30 % at the injection into the diffuser.

The fibre - powder - air stream goes from the diffuser into the moulder, forming a cake, which then is transmitted to a hot moulding press, where it is given its final form and is glued/dried to a firm disk.

Example 2

Wood fibres from a defibrator are blown down into a mixer, where they are mixed with sodium silicate powder of the same type as in example 1 and with magnesium oxide, ratio of components being 8 parts silicate powder and 16 parts magnesium oxide powder to 100 parts dry fibre. The moisture content of the fibre is 35 % at the injection into the diffuser.

The mixture is transmitted by conveyor to an ejector, which disperses it in air and injects it into a diffuser of a moulding machine, in which it is the formed, hot moulded, hardened and dried to required fiberbody.

The cake can also be dried and hardened in heat without being compressed. Thus it gets appropriate density in order to be used as insulating material.

As an alternative to the magnesium oxide - silicate powder mixture a compounding of 10 parts silicate powder and 9 parts zink oxide to 100 parts dry fibre with the same moisture content as the above mentioned can be used.

As indicated in the introduction of the application also other fibres than wood fibres just produced can be used to manufacture products according to the invention. Examples of other suitable fibres are paper - and paperreturn fibres, cotton- , flax- and hempfibres, syntetic polymer fibres, mineral fibres and others.

To the mixture of fibres and glue also powdered fillers as kaolin, chalk, dolomite, quartz and others can be added to attain special qualities as better fire endurance, lower costs, greater stiffness etc.

CLAIMS

1. *Process for producing fibre bodies - disks, profiles, panels, insulating carpets, packing material - according to the dry method, characterised in that the glue required is added to the fibres in the form of a powder of waterglass, which during the continued process is dissolved in the water present transcending into plastic or liquid form, agglutinating the fibres, whereupon the glue dries and hards to a solid bond.*
2. *Process according to claim 1 - characterised in that the waterglass powder contains water, bound to the alcalisilicate in the form of gel-liquid and or water of crystallization.*
3. *Process according to claim 1 and 2, characterised in that also a hardener is added, which converts the alcalisilicate into waterinsoluble silicates during the die-pressing, thus making the fibrebody more water-resistant.*
4. *Process according to claim 1, 2 and 3 characterised in that one of the metal oxides, magnesium oxide, zink oxide or titanium dioxide is used as hardener.*

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00570

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 27 N 1/02								
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="height: 40px; vertical-align: top; border-right: 1px solid black;">IPC5</td> <td>B 27 N</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <p style="padding: 10px 0;">SE, DK, FI, NO classes as above.</p>			Classification System	Classification Symbols	IPC5	B 27 N		
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III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="border-bottom: 1px solid black;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 10%; border-bottom: 1px solid black;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="height: 300px; vertical-align: top; border-right: 1px solid black;">A</td> <td style="vertical-align: top;"> DE, A1, 3302841 (GEISERT, HANS W.) 9 August 1984, see the whole document <div style="text-align: center; margin-top: 20px;"> -- ----- </div> </td> <td style="vertical-align: top; text-align: center;">1</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	DE, A1, 3302841 (GEISERT, HANS W.) 9 August 1984, see the whole document <div style="text-align: center; margin-top: 20px;"> -- ----- </div>	1
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>								
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search 25th November 1991 </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report 1991 -11- 27 </td> </tr> <tr> <td style="padding: 5px;"> International Searching Authority <div style="text-align: center; margin-top: 10px;">SWEDISH PATENT OFFICE</div> </td> <td style="padding: 5px;"> Signature of Authorized Officer <div style="text-align: center; margin-top: 10px;"> Olov Jensen </div> </td> </tr> </table>			Date of the Actual Completion of the International Search 25th November 1991	Date of Mailing of this International Search Report 1991 -11- 27	International Searching Authority <div style="text-align: center; margin-top: 10px;">SWEDISH PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center; margin-top: 10px;"> Olov Jensen </div>		
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00570**

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3302841	84-08-09	NONE	